PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
WY/sd 030345WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IB 2003/002184	10-06-2003	
International Patent Classification (IPC) or national classification and IPC		
H04B1/10		
Applicant		
Nokia Corporation et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 8 sheets, as follows:
      - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
23-12-2004	19-09-2005
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Form PCT/IPEA/409 (cover sheet) (April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB 2003/002184

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☐ the international application in the language in which it was filed

☐ a translation of the international application into _____ ,
which is the language of a translation furnished for the purposes of:

☐ international search (Rules 12.3(a) and 23.1(b))

☐ publication of the international application (Rule 12.4(a))

☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-27 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 27-34 received by this Authority on 2005-05-23

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-2 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-30	YES
	Claims		NO
Inventive step (IS)	Claims	1-30	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-30	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention

The claimed invention relates to the problem concerning noise received in a receiver generated from a transmitter located in the same device.

The problem is solved by controlling attenuation in the receiver to a higher value when the power level of the transmitter exceeds a certain value and to a lower value when no signal is transmitted.

Prior art

In the International Search Report the following documents were cited:
D1: US 6 442 375
D2: EP 1 079 533
D3: US 6 144 473
D4: EP 1 122 554
D5: EP 1 253 720
D6: EP 1 091 497
D7: US 5 691 978
D8: US 6 107 960

D1 describes a system for maintaining operation of a GPS-receiver that is co-located with an interfering transmitter in a single device. According to D1, an AGC control logic monitors the signal from the transmitter to anticipate the beginning of a transmit interval. The AGC control logic generates a control signal that makes the AGC module

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

preserving the gain value through the transmit interval. The AGC control logic thereby makes the GPS receiver less sensitive to the effects of the transmitter, since the gain value does not deviate from normal operation values, which must then be recovered when the interference from the transmitter ceases. (Se abstract and column 5, line 63 - column 6, line 18.)

D2 describes parallel operation in a device comprising both a receiver (GPS) and a transmitter (GSM). To maintain fully operational reception in the device, the input operation of the receiver is modified when the transmitter is transmitting. The receiver operation is modified by the use of a low noise amplifier having at least two biasing conditions. Different biasing conditions are used when interference from the transmitter is present and when it is not present. When transmitter interference is present a biasing condition related to a gain adjustment improving blocking performance is used. When no transmitter interference is present normal biasing operation is used. (See claims 1-5 and abstract.)

Documents D3-D8 represent the prior art. The claimed invention is not considered to be anticipated by these documents.

Statement of reason

None of the cited documents show that the received signals should be attenuated so much that an evaluation of the signals is prevented.

This feature differs from what is claimed in the new independent claims filed after the first Written opinion. This feature offers an alternative solution to the interference problem than the ones shown in the cited documents.

The invention defined in new claims 1-30 is thus not disclosed by the cited document.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed interference reduction. Therefore, the claimed invention is not obvious to a person skilled in the art.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

Accordingly, the invention defined in claims 1-30 is novel and is considered to involve an inventive step. The invention is industrially applicable.

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Amended claims

1. Device (1) comprising:
   - a communication system transmitter (30) for transmitting signals via a radio interface in a first frequency band;
   - a receiver (10) for receiving signals via a radio interface in a second frequency band, said receiver (10) including an attenuation component (13) for attenuating signals received by said receiver (10); and
   - a controlling portion (50) setting an attenuation which is applied by said attenuating component (13) to signals received by said receiver (10) to a higher value in case said communication system transmitter (30) is transmitting signals with a power level exceeding a certain value, and setting an attenuation which is applied by said attenuating component (13) to signals received by said receiver (10) to a lower value in case no signal is transmitted by said communication system transmitter (30), wherein said higher value is sufficiently high to prevent an evaluation of said attenuated received signals, when said attenuation is set to said higher value.

2. Device (1) according to claim 1, wherein said communication system transmitter (30) includes a variable amplifier (32) for amplifying signals which are to be transmitted by said communication system transmitter (30), and wherein said controlling portion (50) sets said attenuation which is applied

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by said attenuating component (13) to signals received by said receiver (10) to a value which increases with an increasing amplification factor of an amplification applied by said variable amplifier (32) to signals which are to be transmitted by said communication system transmitter (30).

3. Device according to claim 1 or 2, wherein said device comprises a communication system section including said communication system transmitter and a receiver section including said receiver receiving signals in a second frequency band, and wherein said controlling portion is located in at least one of said communication system section and said receiver section.

4. Device according to claim 3, wherein said controlling portion includes at least a part of a processor provided in said communication system section and at least a part of a processor provided in said receiver section.

5. Device according to one of the preceding claims, wherein said receiver receiving signals in said second frequency band further includes an automatic gain control component, and wherein said controlling portion combines information from said automatic gain control component and information from a communication system section including said communication system transmitter for determining an attenuation to be set.

6. Device (1) according to one of the preceding claims, wherein said controlling portion (13) determines an

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attenuation to be set based on at least one of the power level of signals transmitted by said communication system transmitter (30) and the power level of signals received by said receiver receiving signals in said second frequency band.

7. Device (1) according to one of the preceding claims, further comprising a communication system receiver (40) for receiving signals in said first frequency band, wherein said controlling portion (13) determines an attenuation to be set based on the power level of signals received by said communication system receiver (40).

8. Device according to claim 7, wherein said controlling portion determines an attenuation to be set based in addition on the power level of signals received by said receiver receiving signal in said second frequency band.

9. Device (1) according to one of the preceding claims, wherein said attenuating component (13) comprises a variable gain attenuator, and wherein said variable gain attenuator (13) applies at least part of said set attenuation to a signal received by said receiver (10) by varying an attenuation applied by said variable gain attenuator (13) to said received signal.

10. Device (1) according to claim 9, wherein said receiver (10) receiving signals in said second frequency band further includes an amplifier (12) for amplifying signals received via an antenna (15) of said device (1), and a processing portion (14) for

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processing signals amplified by said amplifier (12), and wherein said variable gain attenuator (13) is arranged between said amplifier (12) and said processing portion (14).

11. Device (1) according to one of the preceding claims, wherein said attenuating component (13) is integrated with at least one other component (12,14) of said receiver (10) receiving signals in said second frequency band in an integrated circuit (16).

12. Device according to one of claims 1 to 11 wherein said attenuating component is implemented in a dedicated integrated circuit, which dedicated integrated circuit is external to other components of said receiver receiving signals in said second frequency band.

13. Device according to one of the preceding claims, wherein said attenuating component comprises a variable amplifier, wherein said variable amplifier applies at least part of said set attenuation to a signal received by said receiver by varying an amplification factor of an amplification applied by said variable amplifier to said received signal.

14. Device according to one of the preceding claims, further comprising an antenna which is connected to said receiver receiving signals in said second frequency band, wherein said attenuating component comprises a component applying at least part of said set attenuation to a signal received by said receiver by detuning said antenna.

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15. Device according to one of the preceding claims, wherein said attenuating component comprises a component applying at least part of said set attenuation to a signal received by said receiver receiving signals in said second frequency band by reducing at least for one component of said receiver a supplied operation voltage.

16. Device (1) according to one of the preceding claims, wherein said receiver (10) receiving signals in said second frequency band further includes a first converting component for converting a received radio frequency signal into an intermediate frequency signal and a second converting component for converting an intermediate frequency signal output by said first converting component into a baseband signal, and wherein said attenuating component (13) applies said set attenuation to a signal received by said receiver (10) at least at one of a radio frequency, an intermediate frequency and a baseband frequency.

17. Device (1) according to one of the preceding claims, further comprising evaluating means (14) adapted to evaluate said attenuated received signals only in case said attenuated received signals have a sufficiently high power level.

18. Component (50) for a device (1) with a communication system transmitter (30) for transmitting signals via a radio interface in a first frequency band and with a receiver (10) for receiving signals via a radio interface in a second frequency band, wherein said receiver (10) includes an attenuation component (13)

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for attenuating signals received by said receiver (10), said component comprising a controlling portion setting an attenuation which is applied by an attenuating component (13) to signals received by a receiver (10) to a higher value in case said communication system transmitter (30) is transmitting signals with a power level exceeding a certain value, and setting an attenuation which is applied by said attenuating component (13) to signals received by said receiver (10) to a lower value in case no signal is transmitted by said communication system transmitter (30), wherein said higher value is sufficiently high to prevent an evaluation of said attenuated received signals, when said attenuation is set to said higher value.

19. Method for improving the performance of a receiver (10), which receiver (10) is combined in a single device (1) with a communication system transmitter (30) transmitting signals via a radio interface in a first frequency band, and which receiver (10) receives signals via a radio interface in a second frequency band, said method comprising attenuating a signal received by said receiver (10) with a higher attenuation, in case said communication system transmitter (30) is transmitting signals with a power level exceeding a certain value, and attenuating a signal received by said receiver (10) with a lower attenuation, in case no signal is transmitted by said communication system transmitter (30), wherein said higher attenuation is sufficiently high to prevent an evaluation of received signals attenuated with said higher attenuation.

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20. Method according to claim 19, wherein said communication system transmitter (30) amplifies signals for transmission with a variable amplification factor, and wherein signals received by said receiver (10) receiving signals in said second frequency band are attenuated with an attenuation which is increased with an increasing amplification factor used by said communication system transmitter (30) for amplifying signals for transmission.

21. Method according to one of claims 19 or 20, wherein for determining an attenuation to be used, information provided by an automatic gain control for said receiver and information provided by a communication system section including said communication system transmitter is combined.

22. Method according to one of claims 19 to 21, wherein an attenuation to be used is determined based on at least one of the power level of signals transmitted by said communication system transmitter (30) and the power level of signals received by said receiver receiving signals in said second frequency band.

23. Method according to one of claims 19 to 22, wherein an attenuation to be used is determined based on the power level of signals received by a communication system receiver (40) of said device (1) in said first frequency band.

24. Method according to claim 23, wherein an attenuation to be used is determined based in addition on the power level of signals received by said receiver receiving signal in said second frequency band.

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25. Method according to one of claims 19 to 24, wherein signals received by said receiver (10) receiving signals in said second frequency band are attenuated by an attenuation applied by a variable gain attenuator (13).

26. Method according to one of claims 19 to 25, wherein signals received by said receiver receiving signals in said second frequency band are attenuated by reducing an amplification applied to said signals.

27. Method according to one of claims 19 to 26, wherein signals received by said receiver receiving signals in said second frequency band are attenuated by detuning an antenna forwarding signals to said receiver.

28. Method according to one of claims 19 to 27, wherein signals received by said receiver receiving signals in said second frequency band are attenuated by reducing at least for one component of said receiver a supplied operation voltage.

29. Method according to one of claims 19 to 28, wherein signals received by said receiver (10) receiving signals in said second frequency band are attenuated at least at one of a radio frequency, an intermediate frequency and a baseband frequency.

30. Method according to one of claims 19 to 29, further comprising evaluating said attenuated received signals only in case said attenuated received signals have a sufficiently high power level.